chapter gives a description of the habit, habitat and life history of the group, and a discussion of the nomenclature. Directions are given for collecting and preserving specimens.

The æthalioid forms are regarded as the most primitive, while the isolated sporangium with its capillitium is the highest expression of myxomycetous fructification, reached by successive differentiations from the simple plasmodium. The artificial keys follow this sequence. As in the previous monograph, the keys are clear and the descriptions are accompanied by a full synonymy. The plates are well drawn and should readily enable the student to recognize in actual preparations the structures which the figures are intended to illustrate.—CHARLES J. CHAMBERLAIN.

IN examining garden soils near Cambridge University (England) Dr. W. C. Sturgis isolated and studied a large soil bacillus of the type of De Bary's *B. Megatherium*. Of its peculiar life history and morphology he gives an extended account in Phil. Trans. Roy. Soc. London B. **191**: 147–169. *pl. 14–16*. 1899.

LIEFERUNGEN 4 and 5, completing the second edition of the *Flora* of the northeast German Lowlands, have been published.[10]

Nothing need be added to the notice of the earlier parts.[11] The general form and the details of typography are admirable for a field manual. It was announced that the price for the complete work would be raised above the subscription price of *M* 16.50, already high.—C. R. B.

NOTES FOR STUDENTS.

IN THE *Transactions* of the Royal Society of London (B. **190**: 531–621) Mr. Francis Darwin has published the results of interesting investigations on the behavior of stomata. He departs somewhat from the methods of previous investigators, which he does not consider very reliable, and uses the hygroscope method suggested by him some years ago. He has improved upon the stipa hygroscope, using now hygroscopes made of horn shavings and strips of the dried epidermis of *Yucca aloifolia*, so attached to a bit of cardboard bearing graduations that the degree of curvature induced by the moisture from open stomata can be read. The horn hygroscope is quite reliable and has the advantage of showing in a few seconds whether the stomata are open or closed, while the Yucca hygroscope can be used to study accumulating moisture. His results frequently differ from those of previous investigators.

[10] ASCHERSON, P., and GRÆBNER, P.: Flora des Nordostdeutschen Flachlandes (ausser Ostpreussen). Zweite Auflage. Lieferungen 4, 5. 12mo. pp. 481–875. Berlin: Gebrüder Borntraeger 1898. *M* 7.80.

[11] BOT. GAZ. **26**: 363. 1898.

The more important results which he established are as follows: He finds an almost universal closing of the stomata of terrestrial plants during withering, though in almost all cases complete closure is delayed, and after several hours the stomatal transpiration still greatly exceeds the cuticular. The closure is usually preceded by a temporary opening, due to the diminished epidermal pressure on the guard cells. This can be produced more readily in the morning before the stomata naturally open, but not at night after they are closed, and is especially noticeable in laticiferous plants. In many aquatics and marsh plants there is at least a partial closure upon withering, but as a class they do not close to the degree observed in land plants. In many cases where there is no apparent movement at first, closure sets in several hours after withering, and the author asserts his opinion that in no case are the stomata entirely immobile. That closure is correlated with diminished water supply is shown by the invariable closure when the stem is compressed in a vise, and opening when released. Dry air causes closure though the leaves show no signs of flaccidity, and in very dry air the closure is preceded by a prolonged "preliminary opening." The stomata are opened by weak electric currents, but stronger shocks close them. In chloroform and ether vapor they close slowly and then open again, and in CO_2 they slowly close. In bright sunshine they are more widely open than in diffused light, and they close on dark stormy days even in summer. Artificial darkness usually produces closure, and opening occurs when again illuminated, but the time required in each case depends upon the time of day, the normal "daily period" being quite marked. Of the large number of unspecialized terrestrial species tested, only a small percentage do not close their stomata at night. Among nyctitropic plants, whether terrestrial or aquatic, the great majority do not close the stomata at night, and especially if the temperature be fairly high. Even among unspecialized terrestrials, Darwin considers that the closure is not so complete as to prevent transpiration, though it greatly diminishes it. He discusses at some length the ecology of nocturnal closure, but does not seem to think that we know enough about its effects to justify definite conclusions, though he considers the economy of water and of heat to be important factors. A strong tendency toward a daily periodicity is apparent, for much less light opens the stomata in the morning than in the afternoon; conversely, it takes much longer exposure to darkness to close them in the morning than in the afternoon. Dry heat tends to open the stomata; and of the visible spectrum the red rays are the most effective. The effect of prolonged darkness is to reopen the stomata.

The question of the mechanism of the stoma is discussed at some length, and the author seems to think that it is in about the same condition in which von Mohl left it in 1856. As to the immediate cause of the movement, he combines the views of Leitgeb and Schwendener, and holds that it

depends upon the correlation between the pressure of epidermal and guard cells. The phenomenon he considers as one of irritability, the same as nycti-tropic or other irritable movements. An excellent bibliography is appended. —W. B. McCallum.

Professor Pfeffer, in a lecture upon reproduction and the significance of amitosis,[12] calls attention to the fact that the comparative rarity of the amitotic division of the nucleus, together with the enormous attention paid to karyokinetic figures, has led to the belief that cells which show amitosis have lost their reproductive power, and that direct nuclear division presages the death of the cell, a view which is upheld by Strasburger, Ziegler, von Rath, and many other prominent animal and plant cytologists. That this view is erroneous is proved by the behavior of Spirogyra under certain conditions of culture. The cells of this plant continued to grow and divide amitotically for periods of twelve hours or more, the protoplasmic structures produced being in all respects similar to those coming from mitotic divisions, and when the plants were removed to a normal medium the customary methods of cell-multiplication were resumed without variation. The same treatment induced amitotic division in Closterium, and also in the stamen hairs of Tradescantia, but failed to do so in Phaseolus and Lupinus.

Mitosis and amitosis were observed in neighboring cells in callus formations, and the total results from all the material examined show that amitosis may occur in young rapidly growing embryonic tissue as well as in older cells. The occurrence of either method of nuclear division is under control of the regulatory mechanism of the cell. Both are performed as specific reactions to environmental conditions, and intermediate stages of division may be sought for during the alteration of these external conditions. It is not improbable that even such highly specialized structures as egg cells may divide at certain times by amitosis.

It follows that the nuclear figures are not vehicles of heredity in the sense in which they have been so widely considered, a conclusion which has already forced itself upon the workers who have gone most deeply into the subject. Not only must less hereditary value be conceded to the chromosomes, but it must be admitted that the nucleus is not the sole bearer of the qualities of the organism or cell.—D. T. MacDougal.

Botanists probably do not fully appreciate the value of the *Experiment Station Record,* issued by the Department of Agriculture, as an index to current literature. In the tenth volume, just completed, over 2000 articles have been abstracted, of which more than 1200 were foreign. Of these abstracts 127 are classified under botany; 27 under fermentation and bacteriology; 34

[12] Abhandl. d. Math.-Phys. Classe d. Konigl. Sachs. Ges. d. Wiss. zu Leipzig. Sitzung von 3 Juli, 1899.

under forestry; 37 under seeds and weeds; and 180 under diseases of plants; making over 400 with a distinct botanical bearing. Besides these there are abstracts under chemistry, soils, field crops, and horticulture which are often of direct interest to botanists.

INTERESTING INFORMATION regarding rubber of various kinds, its origin, collection, preparation, etc., will be found in recent *Circulars* of the Royal Botanic Gardens of Ceylon, and the *Bulletins* of the Royal Gardens at Kew. Many insects and fungus enemies, some of local origin, some introduced from Assam and elsewhere, are now attacking tea in many parts of Ceylon. The gray blight, a leaf disease due to *Pestalozzia Guepini*, and brown blight, due to *Colletotrichum Camelliæ*, are both now to be found in most districts.—C. R. B.

MR. ATSUSHI YASUDA has in hand work on the influence of inorganic salts upon the conidia formation of *Asperigillus niger*.[13] He finds that increasing concentration of the solutions of K, Na, NH_4, and Mg salts retards the formation of conidia, reduces the size of the fruits, shortens the conidiophores, and promotes the blackening of the conidia. When very concentrated the formation of conidia is suppressed.—C. R. B.

DR. A. J. GROUT suggests[14] that to devise a truly natural classification of the pleurocarpous mosses much more consideration must be given to gametophytic characters than hitherto, since ali arrangements based mainly on sporophytic characters produce juxtapositions of unrelated species, of which he cites abundant illustrations. He is not yet ready, however, to propose a new grouping.—C. R. B.

MR. GEO. MASSEE has a revision of the twenty-six species of Tilletia in the *Bulletin of Miscellaneous Information*, at Kew Gardens, nos. 153, 154. The United States is credited with nine species, ranking next to the continent of Europe with thirteen species.—C. R. B.

A MONOGRAPH of the Danish blue-green algæ is published by John Schmidt in the *Botanisk Tidsskrift* **22**: 283–418. 1899. It is illustrated by thirty-eight figures.—C. R. B.

[13] Tokyo Bot. Mag. **13**: 85. 1899.

[14] Revue Bryologique **26**: 72–77. 1899.